Patent claims

39. A cable insulation stripping apparatus, comprising:

a pair of tool supports (1, 2) for holding at least two tools (3) in pairs, and

a tool support feed means (5) for lateral positioning of at least one of said tools (3a, b, c, d) above a first transport path (100) along which a cable (107) whose insulation is to be stripped can be inserted in its feed direction, wherein

said tool support feed means (5) is formed for a controlled lateral drive for controlled sideward movement of ~~at least one~~ tool supports (1, 2) to any desired position within a working range laterally with respect to said transport path (100).

40. The apparatus as claimed in claim 39, wherein a separate tool support feed means (5a, b) is coordinated with each tool support (1, 2) so that upper and lower positions of said tools (3) can be combined.

41. The apparatus as claimed in claim 39, wherein said tool supports (1b, 2b; 1c, 2c) are held on a common support part (8) and can be displaced together with said common support part (8).

42. The apparatus as claimed in claim 39, wherein said tool supports (1, 2) have, in a lateral direction, a plurality of optionally continually positionable holders for said tools (3), said tools (3) being selectable as required from a group of cable-processing tools.

43. The apparatus according to claim 42, wherein said group of cable-processing tools consists of crimping tools, twisting tools, punching tools, clamping tools, marking apparatuses and grinding means.

44. The apparatus as claimed in claim 39, wherein said tool supports (1, 2) are continuously adjustable relative to one another or toward and away from said transport path (100), (optionally) independently of one another.

45. The apparatus as claimed in claim 39, wherein said tools (3) are arranged in pairs and comprise at least two pairs of knives.

46. The apparatus as claimed in claim 45, wherein one of said pairs of knives is above said cable and another of said pairs of knives is under said cable.

47. The apparatus as claimed in claim 39, wherein said tool support feed means (5) comprises at least one motor and a programmable microprocessor for control of said motor.

48. The apparatus as claimed in claim 47, wherein said tool support feed means (5) comprises a cable absence sensor.

49. The apparatus as claimed in claim 47, wherein a plurality of tool support feed means (5) holding a plurality of tool supports (1, 2) are arranged along said first transport path (100).

50. A cable processing apparatus, comprising:

a pair of tool supports (1, 2) for holding at least two tools (3) in pairs, and

a tool support feeds means (5) for lateral positioning of at least one of said tools (3a, b, c, d) above a first transport path (100), along which a cable (107) whose insulation is to be stripped can be inserted in its feed direction, wherein

an encoder (41) is arranged on an adjusting spindle (14) for tool setting and monitors rotary movement of said adjusting spindle (14) in an operating state as a function of drive movement of a drive (23; 16), optionally by comparison with a comparable encoder value of said drive (23; 16) on said encoder in order to perform at least one of the following: to detect completed closure of said tools (3), to stop said drive movement, to calibrate and to initialize said drive or said encoder.

51. A cable processing apparatus according to claim 50, wherein connection between said drive (23; 16) and said spindle (14) is elastic, optionally a coupling via a toothed belt (24).

52. A process for operating a cable processing apparatus having tool holders and insertable tools, comprising:

employing a monitor that monitors an open state of said tool holders (1) or tools (3) and reduces a drive force of a drive motor (23; 16) shortly before closing said tool holders or tools, so that said drive motor brings said tool holders into a closed position with slight force, and

optionally detecting said closed position of said tool holders by virtue of an encoder connected to or integrated

with said drive motor (23; 16) that loses its steps of rotary movement notwithstanding a supply of drive energy, or that said drive motor (23; 16) comes to a stop notwithstanding a supply of drive energy.

53. A cable processing apparatus having rollers or continuous belts for longitudinal transport of a cable along a transport path (100), wherein said rollers (A, B; 111) or continuous belts (C; 112) are located opposite one another across said transport path (100) and are adjustable relative to one another and can be opened and closed in a cable-dependent and feed-controlled manner.

54. A cable processing apparatus as claimed in claim 53, wherein a cable is received between opened rollers (A, B; 111) or belts (C; 112) and is transported onward by means of rollers (111) or belts (112) that are moved toward one another and held against one another under a contact pressure.

55. A cable processing apparatus as claimed in claim 53, wherein said rollers (111) or belts (112) belonging to two pairs of rollers or belts (A, B; 111; C; 112), are adjustable relative to one another by means of at least one of stepping motors, a control having an automatic RESET, a programmable circuit, and at least one pressure sensor for measuring or evaluating contact pressure on said cable (107) that is coordinated with motors.

56. A cable apparatus as claimed in claim 53, further comprising a control member having a computer which, in an

operating state, after input of cable diameter, and optionally, cable type designation, and desired insulation stripping length, automatically calculates and sets at least one of an initial opening of said roller or belt drive (A, B; 111; C; 112) and a contact pressure for stripping of long insulation sections, and appropriately controls said drives.

57. A cable processing apparatus having drive and processing stations, wherein a common baseplate is provided, on which at least one of drive, feed, tool holders, and measuring or marking modules can be provided in a mountable manner at predetermined positions along a cable transport path.

58. The apparatus as claimed in claim 57, wherein at least one of pairs of continuous belts (112) or rollers (111) of said feed module can be removed without replacement or can be replaced by coated drive rollers (111) or pairs of continuous belts (112), or a continuous belt pair module (C) can be replaced by roller modules (A, B), and vice versa.

59. A cable processing apparatus having drive and processing stations, with at least one movable guide (40) associated with a processing station (3), wherein said guide (40) is connected to a control that alternatively moves said guide completely from a cable transport path (100) during a cable processing mode.

60. The apparatus as claimed in claim 59, wherein at least one guide (40) is arranged on that side of said processing station which faces a cable outlet.

61. The apparatus as claimed in claim 59, wherein said guide (40) can be raised in a radial plane relative to said cable transport path.

62. The apparatus as claimed in claim 59, wherein one guide (40) each, and at least one drive station (C) each, are arranged in front of and behind said processing station (3), and said drive stations (C) are arranged symmetrically with respect to said processing station (3).

63. A process for controlling a cable insulation stripping apparatus, comprising:

employing a program that contains a control for controllable driving of said apparatus, said program comprising program steps coordinated with individual process steps,

combining a plurality of such program steps to form groups of operations, in which a step sequence is predetermined and control parameters of at least one step are selectable or adjustable, and

calling up groups of operations to trigger a plurality of program steps that are preprogrammed in such a manner and result in control of drives in step sequence.

64. The process as claimed in claim 63, wherein at least one of an individual program, process steps and control parameters linked therewith can be set to at least one of 0 and desired other parameters via an input unit.

65. The process as claimed in claim 63, wherein a plurality of program groups are combined to form overlapping program

groups, and wherein individual program groups are shown as an overview and subsequently in detail on a display, said display permitting interactive correction of given values in individual program steps.

66. A continuous cable processing apparatus, comprising:

a cable transport apparatus, which comprises at least one first and at least one second transport means (A, B; C; 111, 112, 113) for linear transport and holding of a cable (107) along a first transport path definable by a cable axis (106),

at least one knife station (E, F, G, 115) for processing said cable (107) along said transport path (100), said knife station (E, F, G, 115) being arranged between two transport means (A, B; C, 111, 112, 113) and, before and after processing of said cable (107), said transport means holding at least one of said cable and one each of cable end regions (107a, b) facing one another and created by said knife station, parallel to said first transport path (100) and so as to be movable in a cable longitudinal direction, wherein at least one of said knife station (E, F, G, 115) and said transport means (A, B; C, 111, 112, 113) is displaceable approximately at right angles or at right angles to said first transport path (100) by means of a motor.

67. The cable processing apparatus as claimed in claim 66, wherein displaceability of one or more transport means (A, B; 112, C, 113) permits parallel displacement of at least of

one of said cable (107) and at least one cable end (107a, b) from said first transport path (100) to at least a second transport path (102, 103), and wherein a further processing station (16, 17) can be coordinated with said second transport path (102, 103).

68. The apparatus as claimed in claim 67, wherein said further processing station comprises at least one transport or processing station (16, 17), selected from the group consisting of an insulation stripping station, a sawing station, a cutting station, a twisting station, a shaping station, a crimping station, a soldering station, a cable processing station and a manipulator arm.

69. The apparatus as claimed in claim 67, wherein at least one transport means (A, B; 111; C, 112, 113), is guided in a linear guide (110) transversely to said transport path (100) and can be moved by a drive apparatus (111 - 114).

70. The apparatus as claimed in claim 69, wherein said transport means is located one each on both sides of said knife station (E, F, G, 115).

71. The apparatus as claimed in claim 67, wherein a drive apparatus (111 - 114) of each movable transport means (111, 112, 113) and at least one independent transport drive, is connected to a common control, and at least one further processing station (16, 17), so that all longitudinal and transverse movements can be performed in a coordinated and time-optimized manner, in synchronization with the processing steps.

72. The apparatus as claimed in claim 71, wherein said transport drive is located one each on both sides of said knife station (E, F, G, 115) and said common control also controls said knife station (E, F, G, 115).

73. The apparatus as claimed in claim 67, wherein two transport means (112) are connected to one another by a common motor-controlled actuator (101) so that, transverse adjustment of one transport means (112a) inevitably results in a diametrically opposite lateral adjustment of the other transport means (112b).

74. The apparatus as claimed in claim 67, wherein at least one transport means (112a) is connected to at least one of said knife station (115) and tool support by a common, motor-controlled actuator (104) so that transverse adjustment of one transport means (112b) inevitably results in a diametrically opposite transverse adjustment of at least one of said knife station (115) and said tool support.

75. The apparatus as claimed in claim 39, wherein a processing station comprises at least one of a rotatable knife, and a second knife station having a rotatable knife (030), whose axis of rotation is along at least one transport path is provided in addition to a knife station.

76. A process for stripping insulation of a cable (107) by means of an apparatus as claimed in claim 75, comprising:

holding a cable (107) in a centered manner on at least two sides, during incision with the knife (030),

arranging at least one holding point in immediate vicinity of said knife (030),

at least one of coupling a knife feed with at least one feed for clamping and centering apparatus and separating said clamping feed from said knife feed, and

at least one of holding at least one of at least one transport means and centering apparatus nonrotationally and rotating said centering apparatus (111; 112) closest to said knife together with said knife.

77. The apparatus as claimed in claim 75, wherein at least one of said clamping and centering apparatus (A, B; 111, C, 112; 013) comprises at least two clamping or centering jaws (111; 112; 013) which lie in a plane, each have a retaining surface, which retaining surfaces are at least approximately perpendicular to a radial plane with the cable (107) and are formed in such a way that closing of said jaws (A, B; 111; C, 112; 013) to approximately zero cable diameter is possible.

78. The insulation stripping apparatus as claimed in claim 77, wherein a cutting apparatus comprises at least two knife jaws (030) which lie in a plane, each having a cutting edge, which cutting edges are formed at least approximately parallel to one tangential plane each of a cable (107) and can be closed to zero and can be advanced to give different initial contact points at an edge with a cable sheath, depending on cable diameter.

79. The apparatus as claimed in claim 47, wherein said knife station, and at least one centering clamping apparatus (A, B; 111, C; 112, 013) are in a form of an automatic processing module (057) which is removably mounted on a continuous cable processing machine (058).

80. The apparatus as claimed in claim 79, wherein said module (057) is connected to a frame of said continuous cable processing machine (058) by a hinge (059) so that said machine can be swiveled out of an axial working position, relative to said cable (107), into a mounting position inclined relative thereto.

81. The apparatus as claimed in claim 77, wherein said centering jaws (013) are L-shaped in section with retaining surfaces that cover a relatively large axial range of a cable sheath and ends that project directly adjacent to said knife (030).

82. The apparatus as claimed in claim 78, wherein, for controlling said rotatable knives (030) along said transport path (100), displaceable rods (060) are provided which have, in a region of said knife holders (015), wedge surfaces (016) which cooperate with diametrically opposite formations of said knife holder (015), said rods (060) coming into contact at another end with a wedge strap (018) which is displaceable along said transport path (100) by nonrotatable actuators (061).

83. The apparatus as claimed in claim 66, wherein said first and second transport means (A, B; C; 111; 112, 113)

each have at least one of one pair of rollers (A, B; 111) and one pair of continuous belts (C; 112).

84. The apparatus as claimed in claim 39, wherein at least one of an upper and a lower roller (111), continuous belts (112) of a pair of rollers, a pair of continuous belts, respectively, and upper and lower tool holders (1) are each displaceable transversely with respect to said transport path (100), relative to an opposite part in each case, so that a twisting procedure can be performed on a cable (107) lying in between.

85. The apparatus as claimed in claim 39, wherein a guide apparatus (9) which can be swiveled at least one of laterally and upward or downward is provided, which guide apparatus can be swiveled at least one of laterally and upward to increase insulation stripping lengths, in order to enable a cable (107) already lying on another side of said tools (3) to be moved back against a feed direction without collision.

86. A process for operating a cable processing apparatus having a cable processing station and tool holders, comprising:

providing a monitoring member which monitors an open state of said tool holders (1) and reduces a drive force of a drive motor (23; 16) shortly before closing of said tool holders, to bring said tool holders into a closed position with slight force, and

optionally detecting said closed position by virtue of an encoder associated with said drive motor (23, 16) that loses its steps of rotational movement notwithstanding drive energy.

87. A cable processing apparatus having a first and a second belt drive for a cable feed, as claimed in claim 39, wherein a gripping apparatus is coordinated with said second belt drive (112b), if required, said second belt drive (112b) releasing said cable (107) so that said cable (107) can be removed by a gripping apparatus.